Soil Oribatei V. Investigations on *Platynothrus peltifer* (Acarina: Camisiidae)[1, 2]

ROY HARTENSTEIN[3]

ABSTRACT

Platynothrus peltifer, an oribatid mite widely distributed in the Palearctic and Nearctic, overwintered as an adult and oviposited from early spring through early September. Eggs developed into adults over an approximately five month period. Its food consisted of fungi and decaying wood and leaves although, when feeding upon the decaying organic materials, most of its sustenance was probably derived from the fungi and other microorganisms. The chief contribution of this mite to soil formation is that of comminuting decaying wood, decaying leaf, and fungal tissues to 1μ–40μ size particles.

Platynothrus peltifer (Koch) 1839 occurs in soils throughout the Palearctic region (Dalenius 1960, Haarløv 1960, Karppinen 1958), Greenland (Hammer 1946), and is abundant in the Tully Forest, N. Y. It has been reported as a vector of anoplocephaline cestodes (Rajski 1959). This paper is one in a series concerned with some of the approximately 25 individual species of an oribatid association in the Tully Forest. Methods and materials have already been presented (Hartenstein 1962).

DESCRIPTIVE DATA

The adult of *P. peltifer* was described and figured as such (Sellnick 1928) and as *Hermannia bistriata* (Michael 1888). Its white, smooth-textured eggs are 225μ long and 150μ in diameter along the short axis.

Larva (figs. 1, 2).—Length 225μ–255μ. Posterior of dorsum with three pair of setae on each side of the median axis, this position of the mite characterized by an irregular surface that appears reticulated and blotched at 540 diameters; anterior of dorsum with a porous shield distinctly different from remainder of integument, persisting through adulthood and indistinctly delineated; short spinous sensilla anterior to the porous shield. Venter with two setae posteriorly; integument with striations as illustrated. All setae and sensillae barbed. Legs I-III with five movable segments, an immovable coxa located ventrally, and a monodactyle claw on the tarsus; the latter longer than the tibia and genu but of equal length to the femur.

Protonymph (figs. 3-5).—Length 480μ–500μ. Differs from larva as follows. Leg IV present, its tarsus setaceous and other segments glabrous; coxae I and III with two pores. Genital plate present. Venter of gnathosoma with single pair of setae. Dorsal setae of idiosoma paired and seemingly arranged linearly along lateral edge of body.

Deutonymph (fig. 6).—Length 550μ–600μ. Differs from protonymph as follows. All leg IV segments except coxa setaceous. Genital plates with three pair of long setae directed posteriorly and an anterior pair of pores. Anal plates with three pair of setae irregularly directed and an anterior pair of pores.

Tritonymph (fig. 7).—Length 720μ–770μ. Differs from preceding stage as follows. Genital plates with six pair of pores—a variable number of such occupied by setae. Anal plates with two pair of setae flanked by three pair.

The setae borne on the dorsum of all mounted immatures may appear to have slightly different arrangements from those described above. The dorsal integument of these organisms is held rather loosely and may shift slightly in the mountant.

BIOLOGY AND ECOLOGY

Litter-soil samples from the Tully Forest were brought into our laboratory on an approximately biweekly basis during the past three years. Sufficiently small quantities of soil and litter were processed through Berlese funnels to allow for what was considered complete extraction in view of the dry appearance of the samples. *P. peltifer* was not found in samples removed from various stands throughout a period exceeding one year. Subsequently, a comparatively dry sample was exhaustively extracted over a 1-week period and, after 3 days, yielded roughly 100 *P. peltifer* in most of 24 funnels. The samples were removed from a site frequently sampled previously but in which the organisms were apparently aggregating. Each funnel contained approximately 6 square inches of soil 1 inch in depth and their litter layer. Careful notes were made of the frequency of occurrence of this mite and the relative ease of extraction. Although quantitative estimates have not been made, it is distributed over most stands on the forest and its distribution suggests considerable clumping or contagion (Hartenstein 1961). Its appearance predominantly in soils removed from hardwood stands which are saturated with water throughout early spring, and well drained and dry in late summer, corroborates the conclusion of Hammen (1952), based on his work and that of others, that *P. peltifer* is indifferent to humidity. It is this fact, coupled with the feeding habits of this mite as discussed shortly, that has allowed this oribatid to become widely distributed and a dominant (Weis-Fogh 1948, Karpinnen 1958) in areas where quantitative sampling has been conducted.

The feeding habits of *P. peltifer* are unlike any of 20 other oribatid mites from the Tully Forest (Hartenstein 1962a). It is not only capable of feeding on decaying leaf or wood tissues but will at times select such food in preference to the fungi *Stemphylium* sp., *Phialophora mustea* Nurgaard and *Cladosporium*

[1] Accepted for publication December 18, 1961.
[2] Specimens of all developmental stages have been deposited in the United States National Museum. This project was supported by National Science Foundation Grant No. G14519.
[3] Department of Forest Zoology, State University College of Forestry at Syracuse University, Syracuse 10, N. Y.

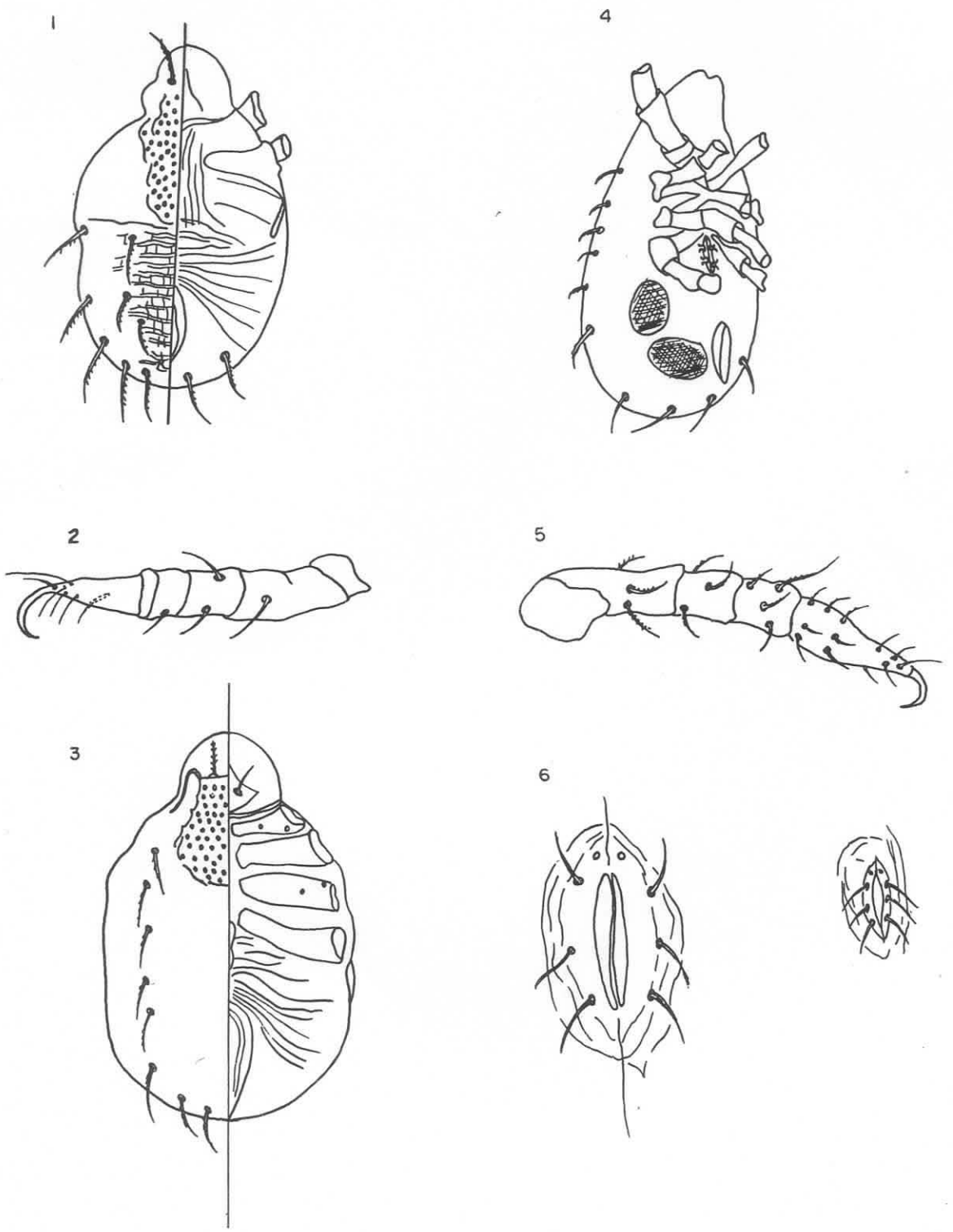

PLATE 1. *Platynothrus peltifer*.—FIG. 1, Dorsal/ventral views of larva. FIG. 2, Leg I of larva. FIG. 3, Dorsal/ventral views of protonymph. FIG. 4, Lateral view of protonymph showing food boluses. FIG. 5, Leg I of protonymph. FIG. 6, Anal-genital regions of deutonymph.

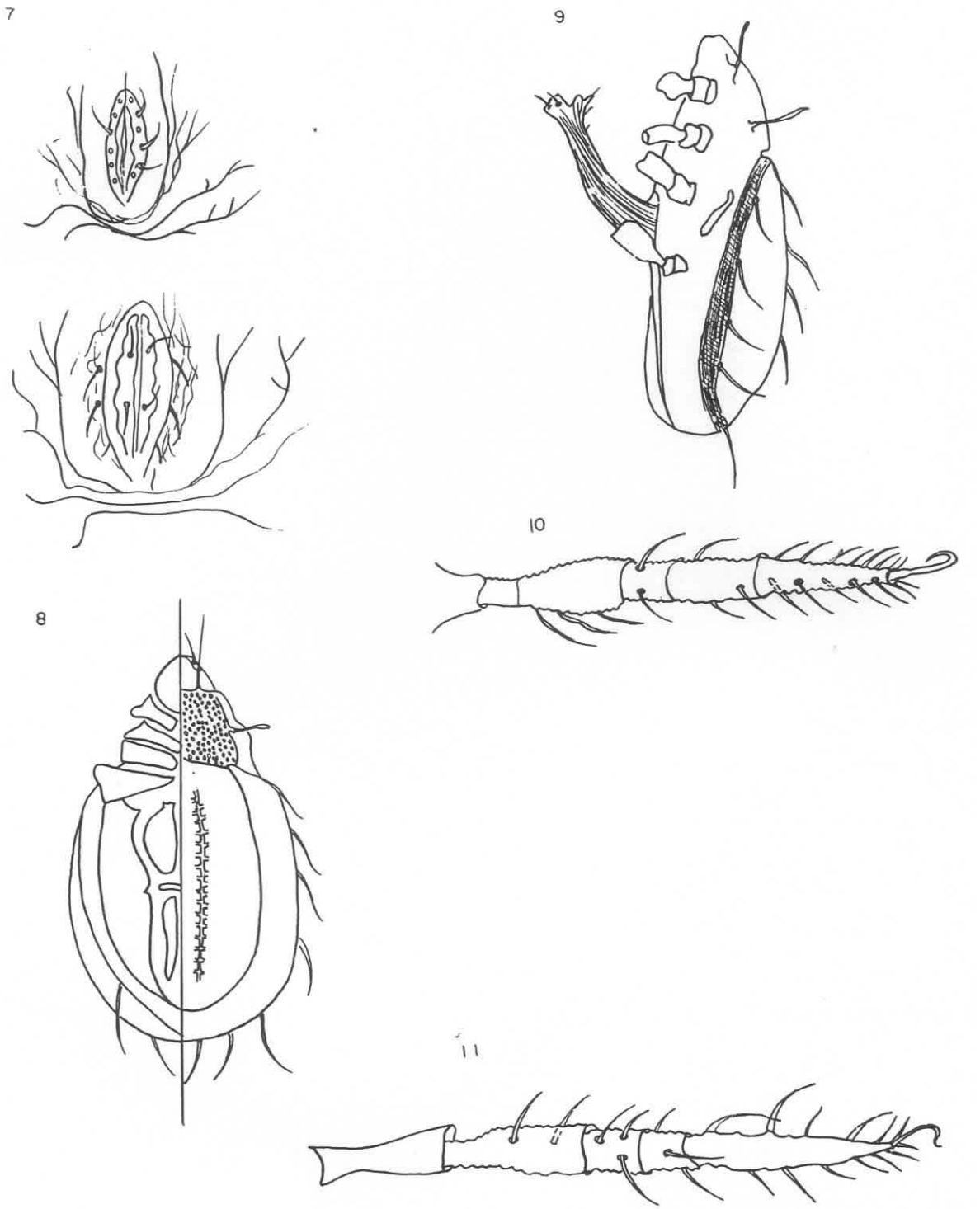

PLATE 2. *Platynothrus peltifer*.—FIG. 7, Genital-anal regions of tritonymph. FIG. 8, Ventral/dorsal views of adult. FIG. 9, Lateral view of adult with extended ovipositor. FIG. 10, Leg I of adult. FIG. 11, Leg IV of adult.

cladosporioides (Fres.) deVries, all of which are amenable to feeding by all developmental stages of this mite. It is entirely plausible and possible that the mite is seeking certain living bacterial and fungal organisms from the decaying tissues. In this sense *P. peltifer* resembles *Protoribates lophotrichus* Berlese (Hartenstein 1962b). However, unlike the latter, it did feed voraciously upon fungi and does preferentially consume the tissues of partially decayed petioles of sugar maple (*Acer saccharum* Marsh) and beech (*Fagus grandifolia* Ehrh.) leaves over fungi and decaying deciduous leaf parenchyma to a far greater extent than *P. lophotrichus*.

A series of experiments was conducted to determine the rate of food passage through the digestive tract, the extent of food comminution, and the morphology of the digestive tract of *P. peltifer*. Its preferred fungus *Stemphylium* sp. and sugar maple leaves decayed aseptically with *Lenzites trabea* (Pers.) for four weeks were fed to isolated individuals in depression slides. The extent of feeding activity among 10 individuals on the fungus at 2- to 19-hour observation intervals for 1 week ranged from zero pellets eliminated in 1 day to the consumption of a sufficient amount of hyphae and spores to form a daily average of eight pellets per individual. Despite the seemingly more resilient structure of leaf tissue, 3 of 10 mites were able to consume a sufficient quantity to eliminate the same daily average number of pellets over a 3-day period. This mite is unable to ingest fresh leaf tissue and perhaps may have been ingesting the laboratory-decayed leaf tissue for the purpose of extracting the fungal tissues.

The following is an account of the course of events occurring during feeding by this mite. Descriptive terms used for anatomical structures of the digestive tract were adopted from Michael (1888). Ingested particles ripped from their food were passed through a short esophagus approximately 150μ in length, to the ventriculus where aggregation occurred until a bolus of definite size was formed. The latter was passed slowly to the colon while a second bolus was formed in the ventriculus. At a given instant, one to three boluses were visible in the animal's linearly arranged digestive system. The third bolus was located anterodorsally to the anal plates, in the rectum. Boluses formed of either the *Stemphylium* sp. or maple leaf tissue required a variable period of time for formation within the ventriculus but remained in the colon and rectum approximately three hours each. Usually 8 to 9 hours were required from ingestion to elimination. The particle sizes in the defecated pellets ranged from 1μ–40μ; the movable digit on the chelicerae of the mite is approximately 50μ long.

Data were obtained to elucidate the life history of this oribatid. Thirty-two or thirty-eight adults survived laboratory conditions (Hartenstein 1962a) from September 1960 through the spring of 1961. Seven eggs were found early in the spring and of these only one was timed from oviposition to hatching. This stage required 35 days. Data on the duration of other developmental stages were obtained from observations on immatures of all stages removed from soil during August of the preceding year. Two protonymphs, extracted from the soil as such, required an additional 27 days to reach the second nymphal stage. One deutonymph had emerged in the laboratory from its protonymph exuviae within a few days after extraction and took 31 days and 24 days to reach the tritonymph and adult stages, respectively. Observations over a 3-month period on more than 50 isolated immatures of all stages, most of which died in the process of molting, indicated that the above-cited durations for development are approximately average.

Additional data on duration of developmental stages for this oribatid were given by Grandjean (1950). According to him each of two protonymphs required 36 days for development to the deutonymph. His data for later stages are considerably higher than those given above but may reflect temperature, dietary, geographical, or genetic differences—or a combination of these differences; they may also be an indication of the variability in development of some Oribatei as shown by Cleat (1952). The latter timed the development of *Scheloribates laevigatus* Koch, living on chicken feces, and obtained a range from 42 to 115 days with an average of 61 days.

The data of Grandjean along with those obtained in this study show that *P. peltifer* requires approximately 5 months for development from egg to adult.

Most of the immatures studied were removed from soils during August. Oviposition occurred in the laboratory from April through the first week of September. The adult deposited the eggs singly. Microscopic examination of whole mounts revealed up to 13 eggs in a female. More than 250 eggs are oviposited by a female during reproduction in a one-year period (Grandjean 1950). Grandjean found eggs deposited in clusters of three or four. He reported periods of oviposition interrupted by long periods during which no eggs were laid and attributed the periods of negative egg production to causes other than temperature because the mites were reared at summer temperatures throughout the winter period. In the present study, dissection of 11 adults during the late fall and 9 adults in January displayed negative egg development. Only the adult could be found in soil extracts during winter and early spring.

Phenological studies by Haarløv (1960) led him to conclude, "that *P. peltifer* has a single generation each year, the youngest stages appear in August-September and the rest of the life cycle completed during the following 11-12 months." From the present study it can also be concluded that this mite has one generation per year. However, the female oviposited from early spring to early September. The young developed to adulthood by December and overwintered quiescently in frozen soils during the winter months.

REFERENCES CITED

Cleat, N. 1952. Growth in the laboratory of economically important oribatid mites. Nature 169: 280.

Dalenius, P. 1960. Studies on the Oribatei of the Torneträsk territory in Swedish Lappland. I. A list of the habitats, and the composition of their oribatid fauna. Oikos 11: 79–124.

Grandjean, F. 1950. Observations éthologiques sur *Camisia segnis* (Herm.) et *Platynothrus peltifer* (Koch). Bull. Mus. Natl. Hist. Nat. (2) 22: 224–31.

Haarløv, N. 1960. Microarthropods from Danish soils; ecology, phenology. Oikos Suppl. 3: 1–176.

Hammen, L. van der. 1952. The Oribatei (Acari) of the Netherlands. Zool. Verhandel. (Leiden) No. 17: 1–139. (p. 36.)

Hammer, M. 1946. Oribatids. *In:* The Zoology of East Greenland. Mikis Fjord. Medded. Grönland 108: 1–53.

Hartenstein, R. 1961. On the distribution of forest soil microarthropods and their fit to contagious distribution functions. Ecology 42: 190–4.

1962a. Soil Oribatei I. Feeding specificity among forest soil Oribatei. Ann. Entomol. Soc. Amer. 55: 202–6.

1962b. Soil Oribatei VI. *Protoribates lophotrichus* (Acarina: Haplozetidae) and its associations with microorganisms. Ann. Entomol. Soc. Amer. 55: 587–91.

Karppinen, E. 1958. Über die Oribatiden der finnischen Waldboden. Ann. Zool. Soc. Vanamo 19(1): 1–43.

Koch, C. L. 1839. Deutschlands Crustaceen, Myriapoden und Arachniden. Heft 29: 9.

Rajski, A. 1959. Miehowcy jako zywiciele posredni Tasiemcow w Sweitte literatury. Zeszyty Naukowe Univ. A. Michiewicza Zeszyt 2: 101–37.

Sellnick, M. 1928. Formenkreis Hornmilben, Oribatei. *In:* P. Brohmer, Die Tierwelt Mitteleuropas 3: 20, fig. 42.

Weis-Fogh, T. 1948. Ecological investigations on mites and Collemboles in the soil. Nature Jutlandica 1: 135–270.